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EASTERN EUROPE: ENERGY OUTLOOK THROUGH 1990

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*no sourcing*INTRODUCTION

Eastern Europe had regarded itself for some time as immune from the energy difficulties that plagued the Western economies during most of the 1970s.<sup>1</sup> At first, the optimism appeared justified. Access to adequate energy supplies--especially cheap Soviet oil--helped support East European economic growth of around 4 percent per annum during the five years following the 1973 onset of spiraling world oil prices.

As the decade drew to a close, however, it was clear that Eastern Europe was beginning to feel the pinch of more costly energy. In particular, the regimes were finding it necessary:

- to reduce their growing dependence on imported oil;
- to boost domestic energy production, especially coal; and
- to establish meaningful conservation programs.

Indeed, many East European specialists wrote that energy shortages would present major challenges to the regimes during

<sup>1</sup> In this paper, Eastern Europe refers to Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, and Romania. East European government sources (statistical yearbooks, trade yearbooks, plan fulfillment reports, and CEMA yearbooks) provide most of the energy statistics used in this paper. Where necessary, we have utilized UN, Soviet, Wharton Forecasting Inc., and other sources to supplement official data. For comprehensive documentation of East European energy data see Energy Supplies in Eastern Europe: A Statistical Compilation, National Foreign Assessment Center, ER 79-10624, December 1979.

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the 1980s.<sup>2</sup> The first few years of this decade have demonstrated, however, that energy shortfalls represent just one of many factors leading to a slowdown in East European growth (see Figures 1 and 2). Other constraints include:

- cutbacks in Western lending and serious debt servicing problems;
- adjustment measures aimed at increasing net exports;
- declining factor productivity; and
- continued economic inefficiency as a result of systemic rigidities.

Many of these problems already preoccupy the leaderships, pushing energy difficulties into the background for the time being. Moreover, forced austerity as a result of the credit crunch has slowed markedly Eastern Europe's demand for energy. Buoyant demand for energy based on projections of a few years ago no longer hold. Nonetheless, all of the regimes continue to stress the importance of dealing with difficulties in the energy sector. Failure to ease energy scarcities will prolong

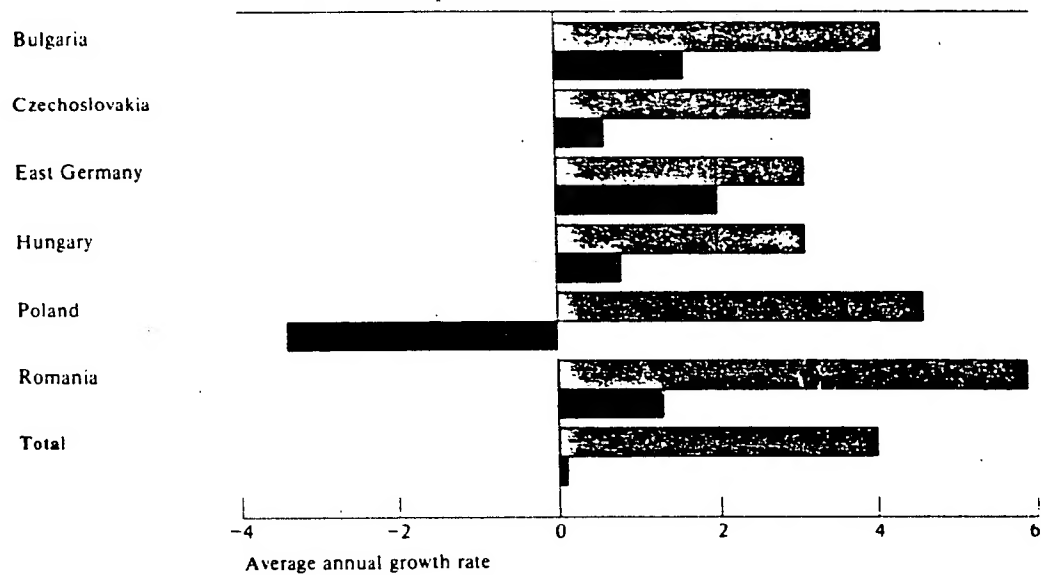
<sup>2</sup> Many articles have appeared over the past few years addressing Eastern Europe's energy difficulties, including articles in earlier volumes of the Joint Economic Committee (JEC). Among these earlier papers are "The Policy Dilemmas of the East Europe's Energy Gap," John M. Kramer, in East European Economic Assessment, Part 2 - Regional Assessments, JEC, (Washington: GPO, 1981), pp 459-475, "The Linkage Between Energy and Growth Prospects in Eastern Europe," Robin A. Watson, "Ibid, pp 476-508, and "Eastern Europe: Growing Energy Problems, John Haberstroh, in East European Economies Post Helsinki, JEC, (Washington: GPO, 1977) pp. 379-395. A couple of other noteworthy papers dealing with this topic are East European Energy, Jonathan P. Stern, (London: Policy Studies Institute and the Royal Institute of International Affairs, 1982), and Eastern Europe's Resource Crises, George W. Hoffman, (University of Texas at Austin; Center for Energy Studies, January 1981).

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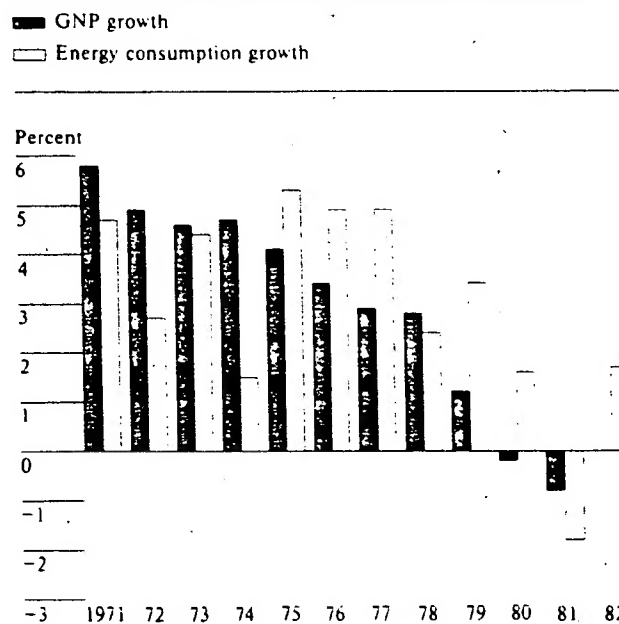
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**Figure 1**  
**Eastern Europe: GNP Growth**

▨ 1966-78  
■ 1979-82



**Figure 2**  
**Eastern Europe: Energy Consumption**  
**and Economic Growth**



bottlenecks and could inhibit economic recovery once external constraints ease.

### The Rise of Oil Dependency

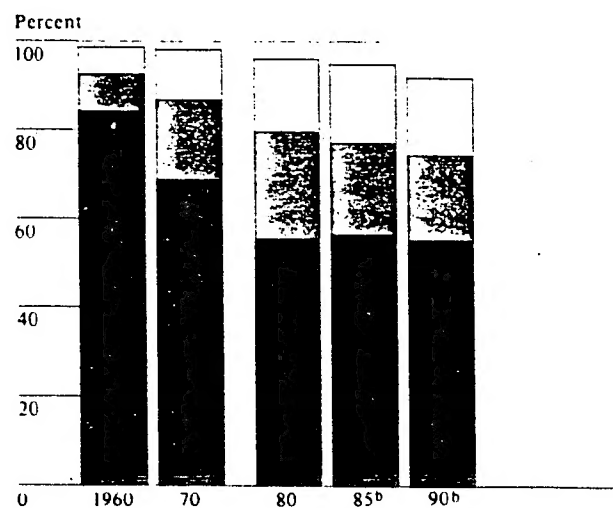
One of Eastern Europe's most pressing energy needs over the current decade is to adjust to tighter oil supplies after having made a deliberate effort over the past couple of decades to reduce reliance on domestic coal and step up the consumption of oil. Coal's share in primary energy consumption fell from nearly 85 percent in 1960 to just 55 percent by 1980 (See Figure 3). During the same period, oil's share of primary energy consumption rose from a little over 8 percent to nearly a quarter. While this level of dependence on oil is still well below Western Europe's, interruptions in supply would have a significant economic impact.

Eastern Europe accomplished this change in its energy mix largely through a dramatic rise in oil imports (See Figure 4). Only Romania had significant domestic supplies of oil, and even it began to boost imports sharply over the latter half of the 1970s as domestic production declined because of dwindling reserves. Thus, Eastern Europe's net oil imports of just 41,000 barrels per day (b/d) in 1960--about 1 percent of primary energy consumption--climbed to over 1.7 million b/d by 1980 or one-fifth of primary energy consumption.

The oil story dwarfed another development in the energy picture--the rise in natural gas consumption. With the

**Figure 3**  
**Eastern Europe: Primary Energy**  
**Consumption by Fuel**

Electricity<sup>a</sup>  
Natural gas  
Oil  
Coal

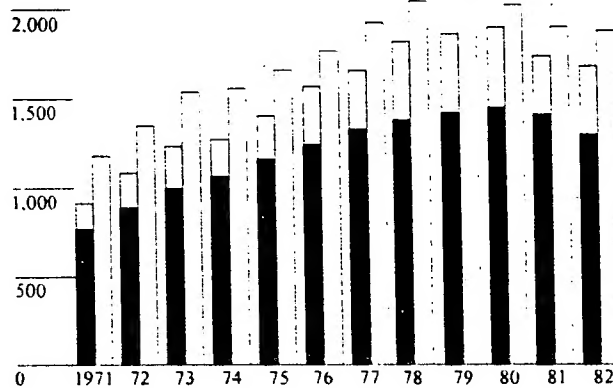


<sup>a</sup> Includes hydro and nuclear power  
<sup>b</sup> Projected.

**Figure 4**  
**Eastern Europe: Oil Consumption and**  
**Crude Oil Imports**

Imports of Non-Soviet crude oil  
Imports of Soviet crude oil  
Total oil consumption

Thousand b/d  
2.500





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completion of the Orenburg pipeline, Soviet gas exports to the area nearly doubled between 1978 and 1980, rising to nearly 30 billion cubic meters (bcm).<sup>3</sup> Even so, by 1980 these imports accounted for just one-third of natural gas consumption and less than 6 percent of total primary energy consumption.

The Soviet Factor The Soviet Union was the chief source of the oil import surge. By 1980, net imports of Soviet oil were running at a rate of almost 1.6 million b/d, accounting for well over 90 percent of the region's total net imports of oil and about two-thirds of total energy imported from the Soviet Union. This increase in oil imports contributed to the region's growing energy dependency on the USSR (see Figure 5). Not only did Soviet oil deliveries rise substantially, but the terms offered Eastern Europe were quite favorable. The Soviets did not raise oil prices to Eastern Europe during the first OPEC price explosion in 1973-74 and have based prices since 1975 on average world prices for the preceding five years. This formula essentially shielded most of Eastern Europe from oil price shocks while providing a continuing subsidy throughout the period of rising world oil prices.<sup>4</sup>

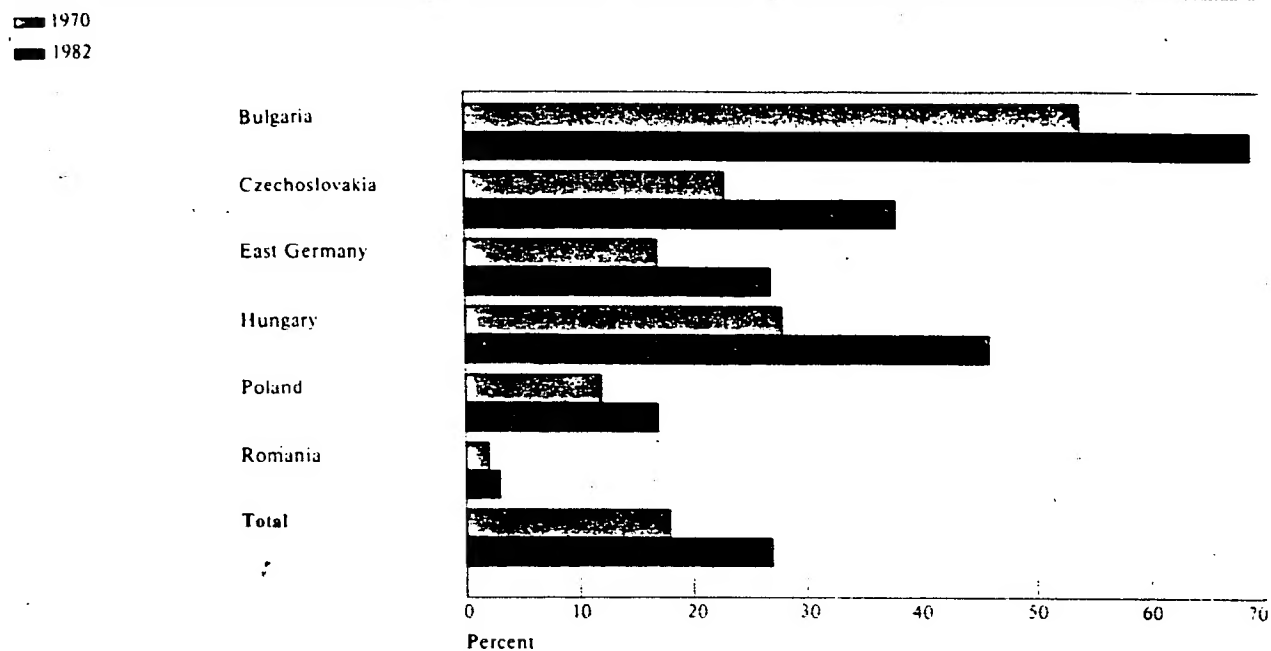
<sup>3</sup> For a more comprehensive look at the use of natural gas in Eastern Europe see The Orenburg Natural Gas Project and Fuels-Energy Balances in Eastern Europe by J. B. Hannigam, (Carleton University; Institute of Soviet and East European Studies, 1980).

<sup>4</sup> An excellent discussion of Soviet subsidies to Eastern Europe, especially the subsidization of energy, can be found in Soviet Subsidization of Trade with Eastern Europe, Michael Mareese and Jan Vanous, (University of California, Berkeley: Institute of International Studies, 1983).

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**Figure 5**  
**Eastern Europe: Energy Imports from the**  
**USSR as a Share of Total Energy Consumption**



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Eastern Europe's access to adequate amounts of cheap Soviet oil came to an abrupt halt in the early 1980s. The region entered the current 1981-85 plan period expecting annual deliveries of oil and coal from the Soviet Union generally to be held constant at the 1980 level. Increases in alternative energy deliveries from the USSR would depend largely on the completion of several large-scale energy projects.

Eastern Europe's energy picture worsened in the fall of 1981 when Moscow informed most of the countries that it would reduce concessionary oil deliveries beginning in 1982 and probably continuing through at least 1985.<sup>5</sup> Annual deliveries to Czechoslovakia, East Germany, Hungary, and possibly Bulgaria were cut by around 10 percent, or by approximately 40,000 b/d each to Prague and Berlin, 30,000 b/d to Sofia, and less than 15,000 b/d to Budapest. Czechoslovakia and East Germany may have made up for part of the cutbacks by additional purchases at non-concessionary prices. The USSR apparently maintained deliveries to Poland because of its precarious economic and political situation. Warsaw reported only a minimal drop in Soviet deliveries of crude oil in 1982. Romania also was not included in this change of policy since it has never enjoyed the favorable terms offered to the rest of Eastern Europe. Bucharest has

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always paid world market prices in hard currency or hard goods for the small quantities of Soviet oil it has purchased. Bucharest, nonetheless, cut back purchases because of its hard currency crunch, reducing its imports of Soviet oil from 54,000 b/d in 1981 to just 7,000 b/d in 1982.

We are not certain of the rationale for the cuts, which came soon after Moscow had promised to maintain constant deliveries, but the Soviets' need for hard currency probably was a factor. Moscow also may have believed that the East Europeans could absorb the oil reductions without jolting their domestic economies. In fact, the countries singled out by the USSR had substantially boosted oil product exports to the West in 1980 - 81 compared with 1979.

- East Germany had doubled its oil product exports to over 80,000 b/d by 1981;
- Czechoslovakia increased exports sharply to over 20,000 b/d in both 1980 and 1981;
- Hungarian exports were up by over 40 percent to 18,000 b/d in 1981; and
- Bulgaria, whose oil product exports were minimal during most of the 1970s, exported some 30,000 b/d in 1980 - 81.

Few OPEC Purchases Current foreign exchange constraints limit Eastern Europe's ability to take much advantage of the recent drop in world oil prices to offset the cutbacks in Soviet

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oil deliveries.<sup>6</sup> Indeed, OPEC oil has never been much of a factor in Eastern Europe's switch to oil except in the case of Romania. Excluding Romania, non-Soviet crude oil imports by Eastern Europe peaked at only 182,000 b/d in 1978, accounting for less than 11 percent of total oil imports and just 3 percent of primary energy consumption.

Romania, on the other hand, sharply boosted oil imports from the Mideast and North Africa in the latter half of the 1970s. With domestic production peaking in 1976 at 294,000 b/d, Bucharest needed oil to feed its growing refining industry. Crude oil imports jumped to 319,000 b/d by 1980, triple the 1975 level, and provided nearly 60 percent of Bucharest's oil needs (consumption plus exports). Well over one-half of these imports came from just three countries: Iran, Iraq, and Libya. During this period, Romania bought small amounts of Soviet oil in an effort to diversify its suppliers, but received no financial breaks.

Some of the East European countries have attempted to take advantage of the current soft world market for oil, both to improve domestic supplies and hard currency earnings from oil sales. Hungary, for example, concluded an arrangement with Iran in late 1982 that increased crude oil imports by 20,000 b/d and thus helped to keep it active in the export market as well as to boost stocks. Before the agreement, crude oil imports had been

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declining steadily since 1978. Low oil prices also helped East Germany and Bulgaria boost OPEC oil imports in 1981-1983 and thus maintain their levels of oil exports. Even Poland hiked crude oil imports to 30,000 b/d in 1983, due largely to imports of 20,000 b/d of Libyan oil that were then reexported.<sup>7</sup>

The other two countries apparently are not making much headway out of current market conditions. Czechoslovakia apparently is keeping its annual OPEC purchases to around 10 thousand b/d at the moment, perhaps a reflection of its conservative financial policies. Romania, which saw its crude oil imports drop 35 percent in 1981-82, is likely to keep imports down as long as its financial difficulties remain.

Whatever benefits Eastern Europe manages to derive from the current drop in prices may be eroded by the negative impact of continuing low crude oil prices on the Soviet Union. In an effort to maintain hard currency earnings from oil exports, Moscow may be tempted to make further reductions in concessionary deliveries to Eastern Europe to free more oil for exports to the West, or to fuel its domestic economy.

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Difficulties with Domestic Energy Production and Conservation

Eastern Europe has not been able to increase its own energy production enough to compensate for the tighter import picture it now faces. Intense efforts to boost production are being hindered by reduced levels of investment, cuts in imports of Western technology and equipment, and declining factor productivity. Estimated production of all energy sources in 1983 was around 6.4 million b/d (oil equivalent) or just 2.8 percent higher than 1978.

Coal The region was hurt by the nearly 20 percent drop in Polish hard coal production between 1979 and 1981, which led to a sharp drop in Polish coal exports to the rest of Eastern Europe. Although Polish hard coal accounted for only a small fraction of the other states' total coal consumption, the high quality of this coal was not easily replaced in certain industrial sectors and its loss forced additional hard currency purchases. The upswing in Polish coal output that began with the imposition of martial law has helped somewhat. Production in 1982 rose by 16 percent, compared to 1981, and total exports nearly doubled. Both production and exports climbed again in 1983, with deliveries to Eastern Europe probably increasing to their pre-Solidarity level.

Elsewhere in Eastern Europe, coal production grew by only 2.0 percent per year during 1979-83, despite efforts to increase output substantially. Indeed, the rate of growth of coal production is quite erratic throughout the region. Romanian coal

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output has grown sharply in the past few years, but the rate of increase varies from year to year and remains well below annual targets. Hungarian coal production continues to stagnate, and while Czechoslovak coal production grew marginally in 1982-83, it is only slightly above the level produced in 1979. Bulgarian coal production fell slightly in 1981, rebounded by 8.5 percent in 1982, and dropped again in 1983. Lignite production in the GDR grew by well over 3 percent in both 1981 and 1982--the best performances in several years--but the pace fell to just 1 percent in 1983.

Despite the enormous efforts being made to increase coal extraction, the East Europeans publicly admit that the following obstacles continue to hinder output and cannot be overcome easily:

- the excessive and increasing ratio of overburden to coal and the high water seepage found in lignite deposits;
- the growing and often acute shortages of machinery and spare parts, especially for equipment purchased in the West;
- the declining calorific content of the coal mined as hard coal reserves dwindle in all of the countries but Poland, leaving the region dependent on low quality brown coal and lignite; and

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-- increasing environmental concerns that can no longer be ignored.<sup>8</sup>

Oil and Gas The region as a whole has meager reserves of oil and gas, with Romania accounting for around three-fourths of the production of these fuels. While Romania actually boosted oil production marginally in 1981 and in 1982, halting a four-year slide, output still remains some 20,000 b/d below recent plans and 60,000 b/d below peak production in 1976 of 294,000 b/d. Bucharest also has increased natural gas output since 1979--contrary to most of its earlier plans to conserve this fuel and probably to help offset the shortfalls in other fuels. The other East European countries, for the most part, are struggling to maintain their modest production of these fuels.

Nuclear Power Nuclear power production has been the one bright spot in the energy picture over the past few years, with output doubling since 1978. Three countries--Bulgaria, Czechoslovakia, and the GDR--produce an appreciable share of their electricity from Soviet-designed nuclear power plants.<sup>9</sup> Bulgaria has been aided by additional output from two 440 megawatt (MW) reactors that came on line in mid-1981 and now derives over a quarter of its electricity from nuclear power.

<sup>8</sup> "Eastern Europe Addresses New Energy Relations," Journal of Commerce, June 22, 1982, and "The Environmental Crises in Eastern Europe," John M. Kramer, Slavic Review, Summer 1983, pp. 204-220.

<sup>9</sup> Much of our discussion on nuclear energy in Eastern Europe is based on the excellent article, "Soviet Policy in the Development of Nuclear Power in Eastern Europe," by Leslie J. Fox contained in Soviet Economy in the 1980s: Problems and Prospects, Part 1, JEC (Washington: USGPO, 1982) pp. 457-508.

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Czechoslovakia two 440 MW reactors, which began operation in 1979 and 1980, provide nearly 8 percent of that country's total electricity production. The East Germans are receiving between 10-12 percent of their electricity from the four 440 MW reactors at Lubmin. As for Hungary, it connected the first reactor at Paks to the electric grid in late 1982.

The increase in the number of nuclear power plants coming on line has not obscured the fact that optimistic targets are not being met. Although electricity production has grown because of new nuclear plants, nuclear power still provides less than 3 percent of primary energy production. The nuclear program has lagged badly from the start, and some problems appear to be worsening. Czechoslovakia, a major supplier of reactor components, has publicly admitted that supplying the rest of Eastern Europe has been a burden to its economy.<sup>10</sup>

Inefficient Energy Use Despite growing problems with its energy supplies, Eastern Europe has been slow to make adjustments on the demand side.<sup>11</sup> Throughout the latter half of the 1970s, the rise in energy consumption continued to exceed GNP growth. Relative to the developed West, Eastern Europe is notoriously inefficient in its use of energy. Per capita consumption of

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"Communists Push Nuclear and other Energy Efforts as Shortages Threaten Political Stability of the Bloc," Wall Street Journal, 6 Oct 1981, p. 6.

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<sup>11</sup> See "Energy Policy and Conservation in Eastern Europe," Leslie Dienes and V. Merkern, also contained in this volume.

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energy for the region as a whole exceeds that of Western Europe, for example, even though per capita GNP and living standards are noticeably lower.

The region was able to postpone serious energy conservation efforts because of the ready availability of Soviet oil at concessionary prices. The initial conservation steps undertaken in the mid-1970s were weak, focusing on consumer education and introducing contests among firms to save energy in the name of "socialist competition." These programs were later supplemented with measures such as daylight savings time, reduced public lighting, alternate weekend driving, and decreeing maximum room temperatures. As the need for more serious conservation initiatives arose, the regimes overcame concern about adverse consumer reactions and sharply increased energy prices in 1979:

- Bulgaria upped prices for gasoline by over 80 percent and for other fuels by 50 to 100 percent;
- Czechoslovakia and Hungary boosted overall energy prices by 50 percent and 34 percent, respectively;
- Romania hiked retail prices of energy by 50 to 100 percent; and
- Poland increased the price of gasoline by 23 percent and fuel oil by 20 percent.<sup>12</sup>

Periodic consumer energy price adjustments--some quite substantial--are now commonplace throughout Eastern Europe and

<sup>12</sup> "Consumer Price Developments in Eastern Europe," Martin J. Kohn, in East European Economic Assessment, Part 2, JEC (Washington: GPO, 1981) p. 335.

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recently have spread to include even industrial energy prices. Only East Germany has remained reluctant to boost consumer energy prices, choosing instead to limit allocations.

For the most part, these East European attempts at conservation have achieved only limited results. The energy-GNP ratio has not been markedly affected by conservation programs, and recent energy savings appear more the result of economic slowdown. Only East Germany--and to a lesser extent, Hungary--appear to have made some headway in this area, with GNP growth in recent years outpacing the increase in energy consumption. Elsewhere in Eastern Europe, increases in output continue to require disproportionately large increases in energy. Several factors contribute to this continuing inefficient use of energy, including:

- an economic reward system based on production plan fulfillment rather than efficiency (profitability);
- outdated industrial plant and equipment installed in an era of cheap energy;
- continued heavy reliance on poor quality coal as a source of industrial energy; and
- conservation programs focusing on households and other non-industrial users, who account for only about one-fifth of total energy consumption.

#### Energy Plans Through 1990

Eastern Europe almost certainly will not overcome its energy

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difficulties in the near-term. Overall energy supplies (production plus net imports) probably will grow by about 1.5 percent a year through 1990 (in b/d oil equivalent or bdoe) compared to nearly 4 percent in the 1970s. Domestic production is projected to grow by 1.4 percent a year, well below ambitious targets. Net energy imports are expected to grow by nearly 2.0 percent a year, largely due to additional deliveries of natural gas and electricity from the Soviet Union over the latter half of the decade as well as to declining exports of oil by Eastern Europe. Soviet oil deliveries are expected to remain flat at best, and foreign exchange constraints will continue to limit purchases of OPEC oil unless prices fall significantly. The bleak supply picture is forcing Eastern Europe to tackle problems on the demand side, and nearly all of the regimes are now focusing more closely on energy conservation. But energy savings are more likely to continue to reflect stagnant economies rather than improved efficiency. In sum, Eastern Europe's pattern of primary energy consumption is unlikely to change much with the exception of some growth of primary electricity consumption (nuclear) at the expense of oil (See Figure 3).

Production Prospects Eastern Europe's official production plans to 1990 are quite sketchy. The sometimes lengthy delays in issuing the 1981-85 plans--and the relative dearth of information once they were released--do not bode well for receiving much from the 1986-90 plans. The regimes appear hesitant to offer detailed projections, realizing how quickly circumstances change.

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Romania, for example, issued energy guidelines to 1990 in late 1979 stressing energy self-sufficiency as the theme. Bucharest has now advanced the date for self-sufficiency to 1985, not because of any great boost in domestic production, but because oil imports have dropped more sharply than anticipated.

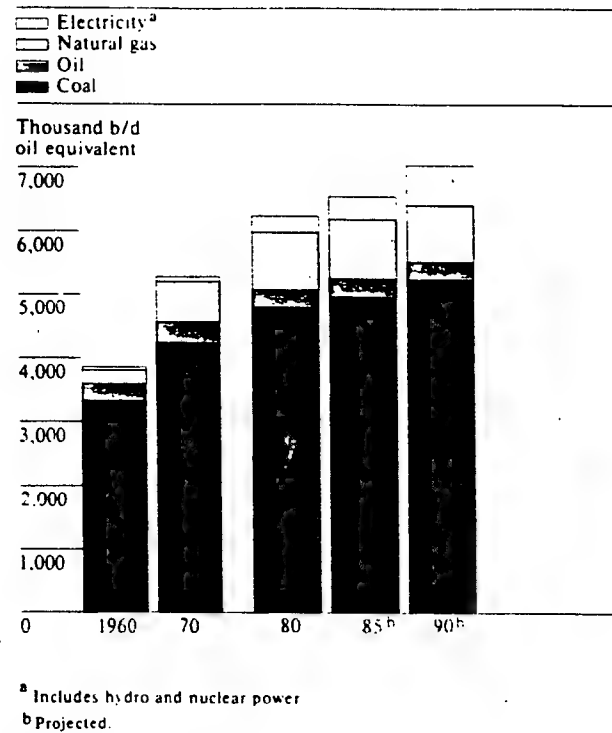
The area's production plans rest almost entirely on increasing coal production and nuclear power capacity. Only Romania seeks to boost oil and gas production significantly--and Romania's oil fortunes hinge largely on what they will be able to extract from the Black Sea. Official East European plans project that coal production for the region will grow by about 3 percent a year through at least 1985, compared with the barely positive growth achieved during 1976-80. Bulgaria and Romania are optimistic, both projecting a doubling in coal output, Bulgaria by 1990 and Romania by 1985. Eastern Europe's production of electricity from nuclear energy is planned to increase sharply, with plant capacity growing from the current level of 4,800 MW to at least 23,000 MW by the end of the decade.

Although energy production should pick up somewhat in Eastern Europe, the regimes' targets are unrealistic. Coal output more likely will grow by only 1 percent annually (in bdoe), at best, given the problems confronting the extractive industry and the current cutbacks in imports and investment (See Figure 6). The production of natural gas and oil will stagnate. Furthermore, the nuclear power program is likely to fall far short of plan objectives. Nuclear power plant capacity

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**Figure 6**  
**Eastern Europe: Primary Production**  
**of Energy by Type of Fuel**



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is more likely to reach about 14,000 MW, or only 40 percent of the planned figure.

Future Soviet Deliveries Eastern Europe still hopes to receive some additional energy from the Soviet Union over the next few years despite the cutbacks in oil deliveries in 1982. While the plans imply that Soviet oil and coal deliveries will remain constant, East European officials mention increasing imports of electricity and gas by at least 320,000 bdoe by 1990. Yet even if deliveries increased according to East European plans, total Soviet energy deliveries probably would account for less than 30 percent of the regime's primary energy consumption by 1990, only a marginal increase from the current share of 27 percent. Exactly how much more Soviet energy might be delivered and how soon--even for the small annual increments of just 2 percent per annum currently talked about--remains highly tentative, and dependent on the completion of several major energy projects. The Soviet Union is likely to fall short of meeting the deadlines currently mentioned and thus significant amounts of new Soviet energy will not be available to Eastern Europe in the near term. Moreover, Soviets might even make further oil cuts to help ease their own problems with domestic oil supply.

The Soviets' ability to increase deliveries of electricity hinges, for the most part, on two major power plants currently under construction in the Soviet Union. Both have hit snags. Hungary, Poland, and Czechoslovakia are helping to construct the

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Khmelnitsky nuclear power station and a corresponding transmission line. The USSR plans to begin deliveries to them in 1984, and by 1990 the three countries hope to be receiving a total of 12 billion Kilowatt hours annually.<sup>13</sup> Construction delays at Khmelnitsky, however, are likely to push back the startup date. Similarly, Bulgaria and Romania are helping to build a nuclear power complex in the southern Ukraine in exchange for future deliveries of electricity, though no amounts have been mentioned. An agreement among the Soviet Union, Bulgaria, and Romania for a transmission line from the plant was reached only in August 1982, which means the plant is not likely to supply electricity to these two countries soon.<sup>14</sup>

Soviet deliveries of natural gas could play an increasingly important role for some of the countries of Eastern Europe. In part, future gas deliveries depend on the completion of new pipelines, including the new Siberia-to-Western Europe pipeline. Czechoslovakia's position appears solid with the Czechoslovak press recently announcing that the country would receive 2 bcm annually from the new pipeline.<sup>15</sup> The Poles have recently announced in the press that they will receive an

<sup>13</sup> "Eastern Europe's Nuclear Future," East European Markets, 29 April 1983, Vol. 3, Issue No. 9, p. 1.

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<sup>15</sup> "New Compressor Development For Gas Pipeline," Prague, HOSPODARSKE NOVINY, 22 April 1983, as reported in East Europe Report, Economic and Industrial Affairs, 2 June 1983, p. 7.

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additional 2 bcm of gas as payment for help on pipeline work within the Soviet Union.<sup>16</sup>

According to press reports, Bulgaria expects to receive up to 10 bcm annually by 1985--nearly double the current level of deliveries.<sup>17</sup> Some of this gas may be tied to the old Orenburg project. Bulgaria is just now receiving its full allotment for work done on this project, with the delay resulting from the failure to complete work on its internal pipeline network.

The Bulgarian situation highlights an important problem regarding Soviet gas--the capability of Eastern Europe to use additional gas imports.<sup>18</sup> Current official plans mention additional deliveries of nearly 15 bcm to Eastern Europe by 1990, either through the new pipeline or unused capacity in the Orenburg pipeline. The Soviets are likely to be in a position to supply much more. The OECD speaks of the possibility of Soviet gas deliveries to Eastern Europe climbing as high as 60 bcm or double the current level of imports.<sup>19</sup> But natural gas is not a good substitute for oil especially, in the transportation sector. Moreover, the current slowdown in investment in the

<sup>16</sup> "Poland to Lay Soviet Gas Pipelines," Financial Times, 6 May 1983.

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<sup>18</sup> For a discussion of this problem see "The Potential for Substitution of National Gas for Oil in Eastern Europe," Wharton's Centrally Planned Economies Current Analysis, Vol II, Number 97, 7 Dec 1982.

<sup>19</sup> World Energy Outlook, OECD (Paris, 1982), p. 192.

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region will impede efforts to switch to gas. Sofia's ambitious plan, for example, depends not only on completing internal pipelines but also on doubling the number of plants that can use this fuel.<sup>20</sup> One Hungarian article points to the slow progress in converting Budapest to the use of natural gas; plans for making home heating dependent on natural gas by 1985 have been pushed back to 1990.<sup>21</sup>

Prospects for Hard Currency Imports Despite poor prospects for domestic energy sources and Soviet deliveries (especially of oil), Eastern Europe is unlikely to purchase large amounts of oil on world markets even at reduced prices. The outlook for the region's hard currency import capacity is bleak through most of the decade because of declining export growth, onerous debt service obligations for some countries, and poor borrowing prospects. Recession in the West has been only one factor contributing to the slowdown in the annual growth rate of East European exports to developed countries to less than 6 percent in the period from 1979 to 1982, versus nearly 15 percent between 1970 and 1978. Many East European goods do not meet Western standards, and the region is losing some sales due to increasing competition from the LDCs. Moreover, continuing deterioration in the terms of trade with the West has required the East Europeans

<sup>20</sup> "Use of Soviet Gas," Sofia, BTA, 15 Feb 1982, as reported in Summary of World Broadcasts, Part 2, Eastern Europe, 25 Feb 1982, p. A/10.

<sup>21</sup> "Slow Progress of Gas Conversion Programme in Budapest," Budapest Home Service, 6 April 1983, as reported in Summary of World Broadcasts, Part 2, Eastern Europe, 21 April 1983, p. A/13.

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to export a greater volume of goods merely to sustain a constant real level of imports.

Deteriorating terms of trade with the USSR also are expected to continue as the cost of Soviet raw materials outpaces the rise in prices for manufactured goods produced by the East Europeans. For example, the CEMA price for crude oil rose to over 90 percent of the world market prices in 1983 and is expected to surpass the world market price by 1984 if no adjustment is made to the current pricing formula. Thus, Eastern Europe could be forced to divert possible hard currency exports to the Soviet Union to maintain imports of Soviet goods and raw materials.

Throughout the rest of the decade, financing problems also will hurt chances for a boost in energy imports. Western bankers still remain cool about lending to the region, including to those countries--Bulgaria and Czechoslovakia--which have their international finances in relatively good order. Without a revival in lending, the prospects are even poorer for a boost in the region's hard-currency import capacity.

Renewed Conservation Efforts Given the bleak prospects for fuel supplies, the East European regimes are planning to put more emphasis on energy savings. The regimes hope to curtail energy requirements through a combination of:

- stabilization measures that will dampen demand;
- some restructuring of the economies toward the less energy intensive sectors; and

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-- more stringent conservation measures designed to improve energy efficiency (i.e. reduced energy-output ratios).

In order to deal with mounting external financial constraints, most East European countries were forced to accept lower growth rates in the late 1970s and early 1980s--which, in turn, slowed growth in the demand for energy. Hungary has been implementing austerity measures since at least 1979, and Czechoslovak officials have acknowledged publicly that little or no growth is expected in the near-term. While Romania and Bulgaria have lowered targets somewhat compared to past plans, publicly announced goals still remain somewhat ambitious. At the same time, East German officials publicly voice confidence in the economy's buoyancy despite extremely slow growth in 1982 and the possibility of difficult financial problems.

East European officials have discussed restructuring their economies to reduce energy demand, but they generally recognize that this is not a near-term solution. Constraints on imports and investment will preclude retooling many plants. Moreover, the worsening unemployment often accompanying structural change would be problematic, especially with officials already concerned over growing consumer frustration. Finally, any moves that would significantly alter production capabilities would have to be considered in the larger context of commitments to other CEMA countries and, therefore, could not necessarily be taken unilaterally.

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Most of the regimes, therefore, are apt to rely even more heavily on conservation programs. We expect that frequent price boosts to both households and industry will continue in all countries except perhaps East Germany. Tighter controls over the allocation of energy, as in East Germany, also are planned. The regimes will probably also pursue conservation measures that have received little attention in the past, including:

- improved insulation, especially in apartments or along heat carrying pipelines;
- greater use of secondary energy sources, including the heat byproduct of electricity production;
- better monitoring of consumption through the installation of metering devices; and
- some upgrading of the capital stock, especially the replacement of inefficient boilers and furnaces.

These East European conservation efforts will have only a limited impact on fuel saving over the next few years. Success would require extensive substitution of new capital for energy, an effort is already seriously impeded by the slowdown of investment throughout the region. In 1981, new investment averaged little more than 6 percent of the total capital stock in the region, and about one-third to one-half of this was needed merely to cover depreciation or replacement of old capital assets. For the next few years, moreover, investment is expected to stagnate or fall.

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Another major impediment to boosting energy efficiency is the large share of coal in the region's energy balance. Even Polish hard coal--the best quality coal in the region--suffers from declining heat content. It is falling by about 0.6 percent a year, according to official Polish data.<sup>22</sup> The regimes nevertheless continue to base their plans on boosting coal production.

Finally, only limited progress toward energy efficiency can be made without market-type economic reforms. Current price hikes will help somewhat, but energy remains underpriced in most of the region. For example, producer prices for natural gas in Romania--the country's largest source of primary energy--remain well below the world market price, despite recent sharp increases. Moreover, as one Hungarian academician notes, boosting energy prices without carefully considering their relationship to one another and to prices of the non-energy factors of production will introduce still further distortions in the economy.<sup>23</sup> Most important, a piecemeal approach to reforming these economies can have only limited success in combatting

<sup>22</sup> "A Reappraisal of Polish Energy Balances," Wharton Centrally Planned Economies Current Analysis, 20 July 1982, p. 1.

<sup>23</sup> "Energy Management Program of Sixth Five-Year Plan Discussed," as reported in East Europe Report, Economic and Industrial Affairs, No. 2462, JPRS 84559, 19 Oct 1982, p. 113.

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waste; energy will continue to be overused as long as production volume rather than efficiency remains the key indicator of success for plant managers.

### Impact on Economic Growth

Recent Experience Eastern Europe enjoyed strong economic growth from the mid-1960s until the second half of the 1970s as a result of adequate energy and labor supplies, buoyant investment, and rapid growth of imports from the West. From 1966 to 1978, East European GNP grew about 4 percent per year, with annual average rates of growth of 3 percent for Czechoslovakia and the GDR at the lower end of the spectrum, compared with rates of growth in excess of 5 percent for both Poland and Romania. Energy supplies rose on average by 4 percent annually over this period, and healthy gains in labor productivity--3 percent per year from 1966 to 1978--resulted principally from accelerating inputs of capital and hard currency imports. The level of investment increased by over 8 percent per year and imports from the West (in current prices) grew by 20 percent per year.

By the late 1970s, energy shortages combined with other problems to slow the economic momentum of Eastern Europe. From 1979 to 1982, annual GNP growth for the region excluding Poland averaged only 1.3 percent. Only East Germany maintained respectable rates of GNP growth (about 2 percent); growth in Czechoslovakia and Hungary fell from over 3 percent in the 12 years before 1978 to virtual stagnation between 1979 and 1982.

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Prospects Economic growth for the rest of the 1980s will remain extremely slow as a result of numerous constraints that continue to affect East European economies. The rapid capital accumulation that contributed substantially to healthy GNP growth in the late 1960s and 1970s will be far less robust in the 1980s. To deal with external financial problems, adjustment programs will curtail investment further, and will continue to squeeze trade surpluses from increasingly strapped domestic economies.

East European planners also have a pessimistic assessment of the growth stimulus that would result from the extensive employment of the "factors of production." Published plans indicate that labor, capital, energy, and even materials are expected to increase only slightly in the 1980s. Thus, whatever growth is realized must come from the intensive utilization of these inputs, that is, higher productivity. Since 1979, however, labor productivity growth has declined steadily except in the GDR where it continued essentially unabated until 1982.

In order to assess East European growth prospects through 1990 under several energy supply scenarios, an analytical model that quantifies the contributions of labor, capital, energy, and other measurable factors to GNP growth is employed.<sup>24</sup> Production

<sup>24</sup> See inset for a brief explanation of the analytical framework used to make these estimates. The quantitative framework used in this paper does not explicitly identify the sensitivity of GNP to trade. To the extent trade has influenced the trend in productivity, its impact is implicitly included in our projection of combined factor productivity trends. For a more detailed explanation of the model, see Watson, op. cit. 1979.

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functions, estimated from East European economic performance since the late 1960s, measure the contribution of labor and capital to GNP growth. While the level of GNP is fairly predictable once labor and capital have been estimated, variations in annual GNP also depend on other factors, including energy supplies, technological change, living standards, systemic problems, and weather.

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BoxHow Energy Supplies Affect Economic Growth: The Methodology

Energy shortages affect economic growth by diminishing the effective use of the means of production. In particular, energy shortfalls limit the operation of transportation equipment and machinery. In order to estimate the impact of energy shortfalls on economic growth prospects, we proceed through five steps.

1. Forecast energy required to operate the capital stock:

Expected additions to the capital stock can be estimated by extrapolating historical rates of capital accumulation as a function of investment. Because annual capital retirements include only about 2 percent of the existing stock, levels of gross investment exceeding 2 percent of capital stock provide for net capital expansion. Thus, despite constant or even declining levels of investment, we expect capital stock to continue to expand, albeit at a much slower pace than experienced in the 1970s. For the region as a whole, we expect the capital stock to grow at nearly 4 percent per year through 1990.

Energy efficiency (energy per unit of capital) has improved at an average rate of 1 to 2 percent per year since the mid-1960s. Despite declining efficiency prospects because of investment slowdowns and diminishing import capacity, we optimistically project that the annual gain in efficiency will continue to average nearly 2 percent per year through 1990. These trends in energy efficiency--combined with projected capital stock--yield our estimate of the growth in energy demand (i.e., the energy required to operate the capital stock). Our estimate shows that energy requirements will continue to grow at an average rate of about 1 to 2 percent per year through 1990--a marked slowdown relative to annual rates near 4 percent in the 1970s.

2. Estimate energy supply prospects:

We combine our projections of indigenous energy production capabilities with our estimates of likely net imports from within CEMA (principally from the Soviets) and from the hard currency market to arrive at energy supply forecasts. We expect that energy supplies for the region will increase about 1.5 percent per year through 1990.

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### 3. Calculate a measure of energy shortage:

The difference between our projection of energy requirements and energy supplies allows us to determine the existence and size of energy shortages. Our estimates of energy balances for Eastern Europe through 1985 indicate that shortages will grow. In several countries expected energy supplies fall behind demand by as much as 10 percent by 1985.\* For the remainder of the decade, however, growth continues to slow for other reasons, and energy shortages may be less constraining.

### 4. Assess the effect of energy shortages on capital utilization:

We assume that the ratio of energy supply to demand reflects any sacrifice in capital utilization due to energy shortages. If, for example, only 90 percent of nominal energy demand can be met, 10 percent of potential capital services are lost. Effective capital stock is thus defined to be total capital multiplied by the energy supply-to-demand ratio. If capital were the sole productive asset, GNP growth would be directly proportional to the change in effective capital. However, since capital is only one factor of production, potential GNP is diminished by something less than the energy supply-to-demand ratio. Labor, the other principal factor of production, is less directly affected by energy availability.

### 5. Evaluate the impact of reduced capital services on growth:

Using historical data, we estimate the shares of GNP growth attributable to capital and to labor, and we use these relationships to forecast GNP. The relevant measure of capital services in this calculation is the effective capital stock. Because only about a third of GNP is contributed by capital, a reduction in the energy supply-to-demand ratio by 3 percent, for example, would reduce potential GNP by about 1 percent.

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\* Energy shortages are necessarily an ex ante phenomenon. By the end of 1985, for example, adjustments (such as lower GNP) will have been realized, and ex post supply and demand will, of course, be the same.

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The sharp decline in productivity since the late 1970s seems attributable to the combined influence of these factors and none are expected to provide a stimulus to growth over the next several years. Estimates in the scenarios below are based on productivity trends for the period 1978 to 1982, which may be too optimistic because productivity could decline further as a result of stagnant or declining imports, declining living standards, and an aging capital stock. In every country, productivity growth has been noticeably slower in one or more recent years than the projection. (See Table 1 for projections of the most important economic indicators used in our estimates.)

#### Medium Term Growth Prospects - 1983-85

Scenario 1: No Energy Shortage In this scenario, potential economic growth in the absence of a shortage of fuels is estimated in order to assess the fraction of the expected growth slowdown which is due to constraints other than energy. With energy supplies sufficient to operate the capital stock at capacity, growth in the region as a whole would average only 1.4 percent per year through 1985, a marked slowdown relative to performance from 1966 to 1978 but a slight improvement over recent experience (see Figure 7). Adequate energy supplies thus would enable regional growth to recover moderately from the virtual stagnation since 1978. The growth potential of Czechoslovakia, Hungary, and Romania in particular would be better in this scenario compared with the last four years. To

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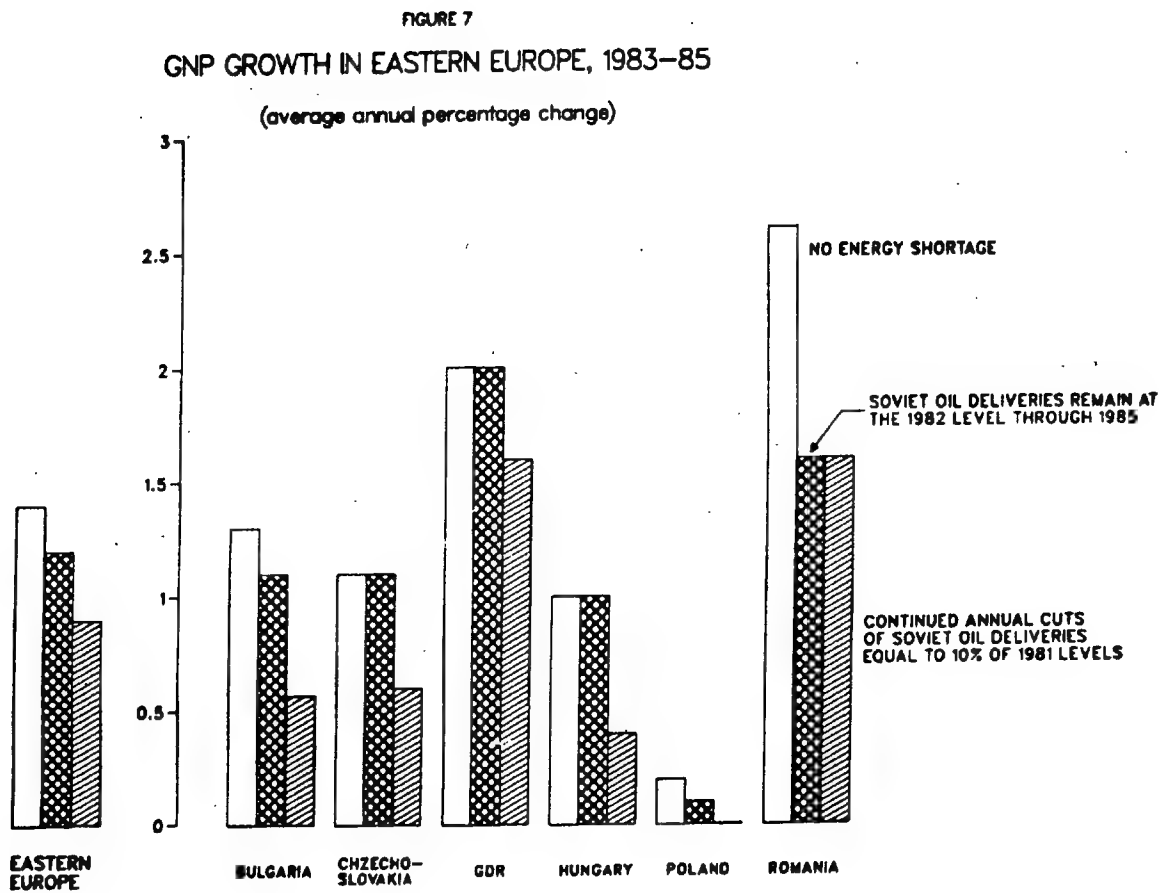
Table 1

EASTERN EUROPE: KEY PROJECTIONS, 1983-1990  
(Average Annual Rates)

	<u>BULGARIA</u>	<u>CZECHO-SLOVAKIA</u>	<u>GDR</u>	<u>HUNGARY</u>	<u>POLAND</u>	<u>ROMANIA</u>
Employment	0.3	0.6	0.4	0.2	0.7	1.2
Investment	0	0	0	0	0	0
Capital Stock	5.4	3.3	3.1	3.1	1.8	4.9
Energy Efficiency						
of Capital <sup>a</sup>	3.3	2.2	2.0	1.8	1.4	3.3
Energy Required for						
Full Capital						
Utilization	2.1	1.1	1.1	1.3	0.3	1.5
Industrial						
Productivity <sup>b</sup>	-1.0	-1.5	0	-1.0	-3.0	-2.0

<sup>a</sup> Projected annual improvement in energy per unit of capital--equal to average annual trend from 1965 to 1982.

<sup>b</sup> Projected annual change in combined factor productivity in industry relative to the average annual performance from 1965 to 1982.



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sustain even this modest rate of growth of regional GNP, however, would require substantial additional energy imports by 1985. Such costly imports would be very unlikely for the next several years in light of continued balance of payments problems and the desperate need for non-energy imports.

Scenario 2: Soviet Deliveries at 1982 Level Through 1985

A far more likely scenario is based on no increase in energy purchases on the world market and assumes that concessionary Soviet deliveries of oil remain at the 1982 level through 1985. An expected moderate increase in domestic production would allow energy supplies to grow, but by only 1 percent per annum through 1985. Projections of capital growth and annual efficiency gains at the rates achieved since 1966 indicate annual energy demand increases of about 1.5 percent through 1985 for the region as a whole. The disparity between nominal energy requirements and available fuels would depress regional economic growth through at least mid-decade. As a result of energy shortfalls, GNP growth would average less than 1.2 percent annually through 1985, down only marginally compared to growth with no energy constraints.

The following summarizes differences in the outlook for individual countries in the region:

- East Germany's ability to improve energy efficiency, if sustained, would prevent energy shortages despite only modest growth of supplies. GNP is likely to grow by about 2 percent per annum, the same rate as in the

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unconstrained case but still one-third lower than the rate recorded between 1966 and 1978.

- Czechoslovakia would find growth slowing sharply as compared to the 1970s but not primarily as a result of serious energy shortages. Non energy factors--primarily obsolescent capital stock--are expected to keep the average annual growth rate of GNP at about 1.3 percent through 1985 in both scenarios, or less than one-half the growth rate achieved in the 1966-1978 period.
- Bulgaria's relatively small economy--combined with its capacity to expand modestly domestic energy supplies and maintain significant energy imports from the Soviet Union--should allow it to meet most of its energy needs. The annual growth of GNP through 1985 thus falls just marginally from the unconstrained case to an average of about 1.1 percent. The marked slowdown in growth from the more than 4 percent annual average rate during 1966-1978 is due largely to continuing productivity problems.
- Hungary's energy supplies are expected to fall short of demand for the next several years as a result of domestic production problems and the regime's external adjustment measures. GNP growth would be about one percent per annum.
- From 1983 to 1985 Romania's energy inefficient economy would grow by less than 2 percent annually, compared to

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the nearly 3 percent rate feasible in the unconstrained scenario. In both scenarios the GNP growth rate would be cut by more than half compared with performance during the 1966-1978 period.

-- In Poland, other problems overwhelm any prospective energy shortages, and we project virtual stagnation over the next few years in both scenarios.

### Scenario 3: Continued Cuts in Soviet Deliveries

In Scenario 3, the impact of a significant decline in the region's energy supplies is assessed as a result of further annual cuts in concessionary Soviet oil deliveries equal to 10 percent of 1981 levels, as were imposed on Czechoslovakia, Hungary, the GDR, and possibly Bulgaria in 1982.<sup>25</sup> This scenario assumes that Eastern Europe does not compensate for these lower deliveries by increasing purchases from other oil producers. Such cutbacks would further crimp growth everywhere but in Romania, which traditionally has not received cut-rate Soviet oil. Regional growth would fall considerably short of 1 percent, with some countries confronting stagnation or actual declines in GNP.

<sup>25</sup> This scenario was examined to assess the vulnerability of the East European economies to further cuts in Soviet oil. The microeconomic nature of the models we employ assumes that coal, oil, gas, and electricity are easily substitutable energy sources. Yet these interfuel substitutions are plausible only for marginal shifts; continued oil cutbacks of 10 percent per year would undoubtedly cause microeconomic bottlenecks which are not treated explicitly in this model.

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- Bulgaria, Czechoslovakia, and Hungary--traditionally large recipients of Soviet oil--would find growth dropping sharply in the face of sustained cuts in Soviet oil. GNP growth would virtually stagnate in Bulgaria and Hungary and drop to just 0.5 percent in Czechoslovakia.
- Further cuts in Soviet oil would also hit East Germany with GNP growth slowing from 2.0 percent to about 1.6 percent per annum through 1985.
- Poland is almost entirely dependent on the USSR for its oil supplies and could ill afford to be included in the next round of reductions. The loss of 10 percent of its Soviet oil imports would assure even steeper declines in GNP as noted in the second scenario.

#### Growth Prospects for the Remainder of the Decade, 1986-90

Problems other than energy make East European economic growth prospects in the latter half of the decade so poor that energy supplies may not pose an additional constraint.<sup>26</sup> Under the best of assumptions about energy supplies, economic prospects would be dimmed by a host of other factors, including:

- the sluggish growth of the industrial labor force due to demographic trends and depletion of the once-large pools

<sup>26</sup> If oil production fails to meet total Soviet requirements for domestic consumption, hard currency export earnings, and CEMA deliveries, Moscow might substantially reduce concessionary deliveries to Eastern Europe. The ensuing bottlenecks could markedly erode regional growth potential probably turning growth negative in most of the East European countries. The most important effects would be microeconomic, which are not accounted for in the aggregate-type model employed here.

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of agricultural labor;

- stagnant or declining labor productivity because of slow growth of investment, falling living standards, and continued systemic rigidities which thwart incentives; and
- hard currency shortages that are likely to persist due to heavy debt service obligations, Western reluctance to boost lending to the region, and the continuing failure of many East European goods to meet the standards of Western markets.

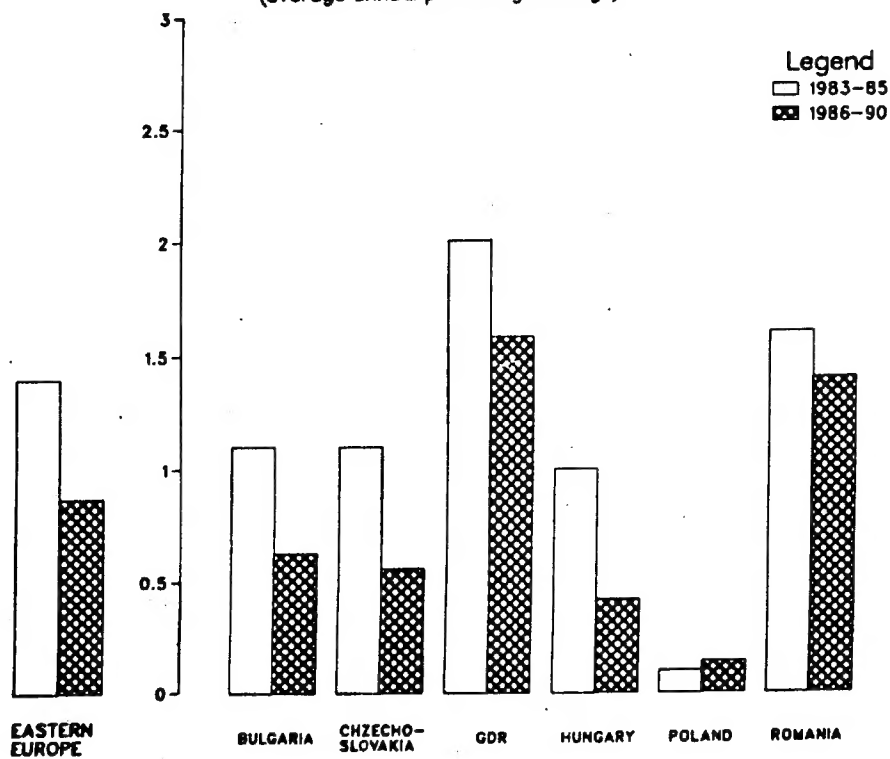
Using the model with the same economic indicators shown in Table 1, the rate of growth of energy demand is projected to slow to less than 1 percent per year in the latter half of the eighties. The rate of growth in energy supplies is projected to grow at about 1.5 percent annually and would satisfy these minimal requirements. This average annual rate of growth assumes growth in domestic production of energy of around 1.4 percent per year and an annual increase in net imports--largely Soviet gas and electricity as oil deliveries are held constant--of a little over 2 percent. Figure 8 shows economic growth prospects in the latter half of the decade compared to the estimates in the most likely scenario (Scenario 2) for 1983-85. GNP for the region as a whole is projected to average less than 1 percent a year.

- Growth in Bulgaria, Czechoslovakia, and Hungary is expected to fall to around 0.5 percent a year, half the rate of growth projected in the most likely scenario for

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FIGURE 8  
EASTERN EUROPE: PROJECTED ECONOMIC GROWTH RATES  
(average annual percentage change)



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1983-85. This decline is due mostly to diminishing productivity in these three countries.

- In Romania, relatively healthy growth in the supply of labor and in the capital stock sustains GNP growth over 1 percent per year despite adverse productivity and efficiency trends.
- Near stagnation is projected to continue in Poland, though uncertainty is so great that economic prospects by 1990 could be significantly altered by a variety of factors.
- East German growth prospects in the longer term of over 1.5 percent per year are substantially better than the remainder of the region based on the possibly questionable assumption that East German productivity doesn't decline despite economic adversity.

Confidence in these projections diminishes rapidly as the forecast horizon is extended. The situation could become even worse, for example, should the Soviet Union impose still further cuts in its deliveries of oil. On the other hand, brighter growth prospects are possible if extensive reform programs or radical improvements in the external situation improve productivity prospects over the latter half of the eighties.

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